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**B5A AT19PA A1R314C3 A1R460 A2A1 A2A2 A2D2  
A2U2 A2U5 A2U9****B1D DBEB****B5B BCP B35Y B38Y B902****D1R RGL R151 R201 R354 R544****U1S S1604**

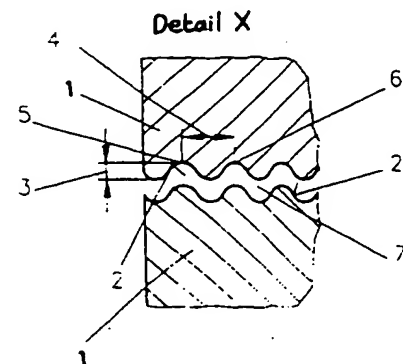
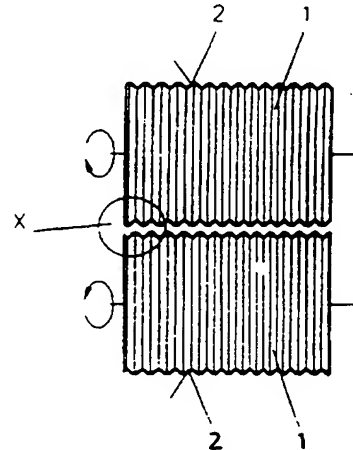
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**GB 1417696 A****GB 1372350 A****GB 1312560 A****GB 0725973 A WO 91/05483 A1**

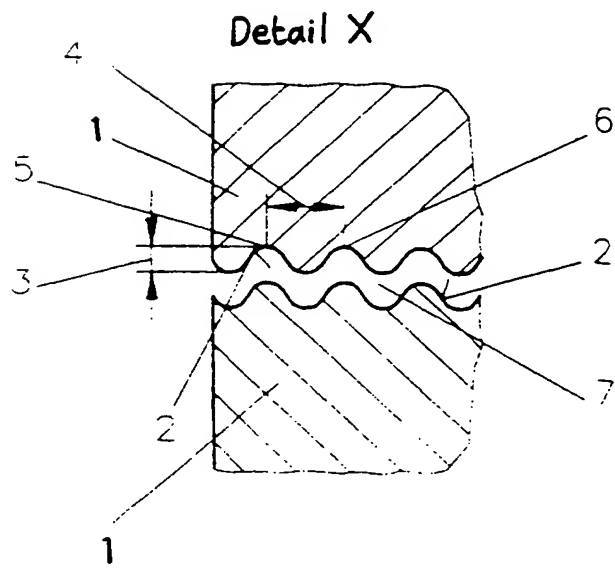
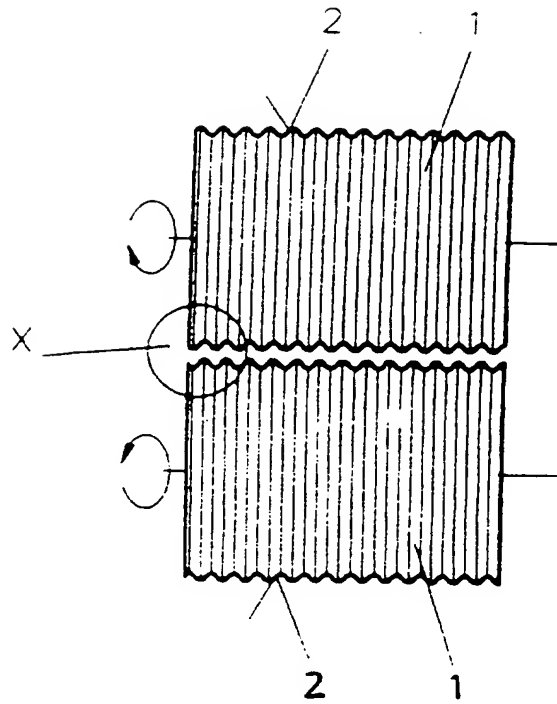
(58) Field of Search

**UK CL (Edition O ) B1D DBEB DBHA DBHX DDQA ,  
B5A AA1 AT19PA AT19PC AT19PD , B5B BCG BCM  
BCN BCP BEB BEC , D1R RFL RGL  
INT CL<sup>6</sup> B01D 39/14 39/16 , B29C 43/24 , B29D 7/00  
7/01****Online:WPI****(54) Production of pleatable filter material from non-woven plastics material**

(57) A method for producing a pleatable filter material from a thermally bound nonwoven material in which a fibrous web is first formed from drawn and non-drawn synthetic fibres and is subsequently calendered, being consolidated between profiled calender rolls 1 so as to be stress-free over its cross-section and without non-homogeneities, spacers, for spacing apart folds subsequently formed in the material, being formed in the filter material itself.

**GB 2 315 704 A**

1/1



Filtering material, method for producing it  
and apparatus for carrying out the method

The invention relates to a method for producing a pleatable filter material from a thermally bonded nonwoven material, spacers for spacing apart folds being formed from the nonwoven material itself.

Such a method is known from EP 0 429 805 B1. In this case, a flat filter medium is gathered by means of rollers and is then heated to its deformation temperature and guided between the jaws of a shaping means, so that oblique grooving is obtained. A disadvantage of a filter medium subsequently treated in this way is that the grooves or spacers of the pleated filter element markedly regress again even at relatively low operating temperatures of 50 to 70°C.

Furthermore, synthetic nonwoven materials used as pleatable filter media are known on the market, and in these materials, parts of the surface of the material are consolidated over the cross-section to a greater extent than the rest of the surface. This likewise gives rise to a reinforcing three-dimensional structure which may be referred to as spacers. However, a disadvantage of such media is that the local consolidations lead to marked non-homogeneities which have an adverse influence on the separation properties of the filter medium as a whole.

It is an object of the invention to develop further a method of the type mentioned above in such a way that the spacers are produced without any change in the homogeneity of the nonwoven material, do not change their shape and remain stable for their entire useful life during filtration even under the influence of mechanical and/or thermal loads.

Accordingly, from a first aspect, the invention provides a method for producing a pleatable filter material from a thermally bonded nonwoven material, spacers for spacing

apart folds being formed from the nonwoven material itself, wherein a fibrous web is first formed from drawn and non-drawn synthetic fibres and is subsequently calendered, the fibrous web being consolidated between profiled calender rolls so as to be stress-free over its cross-section and without non-homogeneities. At the same time, the non-drawn fibres, with their low melting point, serve as binding fibres. This gives rise to a nonwoven material with the high inherent stability necessary for pleating, possessing, by virtue of its already existing three-dimensional structure, spacers for the folds which are made later. These spacers remain stable during filtration even under the influence of mechanical and thermal loads. It is advantageous that the finished filter material does not have to be heated again after the spacers have been imparted in a single calendering process. Restoring forces within the filter material, which may lead to undesirable deformation of the spacers, are reliably ruled out after production and for the entire useful life of a filter insert made from the filter material.

The fibrous web may be preheated and may be guided between heated or cooled calender rolls. Alternatively, an unheated fibrous web is guided between heated calender rolls.

The fibrous web is directly calendered with a three-dimensional structure and consolidated thus, without having to go through flat calendering.

From a second aspect, the invention provides a filter material produced by the method according to the invention, wherein the spacers are formed by raised portions, the height of which corresponds to at least one quarter of the thickness of the filter material. The embossed raised portions remain unchanged, without deformation, for the entire useful life of a filter insert made from the filter material.

Moreover, the invention relates to apparatus for producing a filter material.

Such an apparatus is known from EP 0,429,805 B1 and suffers from the disadvantage mentioned above.

5 It is a further object of the invention to develop an apparatus of this type in such a way that the spacers are produced without any change in the homogeneity of the nonwoven material, do not change their shape and remain stable for their entire useful life during filtration even  
10 under the influence of mechanical and/or thermal loads.

Accordingly, from a third aspect, the invention provides apparatus for carrying out the method of the invention and for producing the filter material of the invention, comprising calender rolls having a surface profiling which,  
15 viewed in cross-section, extends essentially sinusoidally in the axial direction. The ratio of the height of the surface profiling in the radial direction and the axial width between mutually adjacent vertices is preferably 0.1 to 0.2, the surface profiling being continuous in the  
20 circumferential direction. The calender rolls preferably comprise steel and apply a linear pressure of 20 to 60 bar, for a calender roll width of 1.2 m, to the fibrous web.

The calender rolls may be operated either cold in the case of a preheated fibrous web or hot at temperatures up to the  
25 melting point of the non-drawn fibres in the case of a preheated or non-preheated fibrous web.

The invention will now be described by way of example only with reference to the single drawing, which shows an embodiment of calender rolls for use in apparatus for  
30 carrying out the method.

The upper part of the drawing shows calender rolls 1, between which the fibrous web is guided for consolidation,

including the formation of spacers. The calender rolls 1 are heatable and have surface profilings 2 which, viewed in cross-section, are essentially sinusoidal.

The lower part of the drawing shows a detail X of the two  
5 calender rolls. It can be seen that the surface profilings  
2 of the two calender rolls 1 are congruent to one another.  
The ratio of the height 3 of the surface profilings 2 in the  
radial direction and the axial width 4 between mutually  
adjacent vertices 5, 6 is 0.15 in this embodiment. The nip  
10 7 between the two calender rolls 1 can be set exactly at 0.1  
mm constantly over the entire sinusoidal nip.

Claims

1. A method for producing a pleatable filter material from a thermally bonded nonwoven material, spacers for spacing apart folds being formed from the filter material itself, wherein a fibrous web is first formed from drawn and non-drawn synthetic fibres and is subsequently calendered, the fibrous web being consolidated between profiled calender rolls so as to be stress-free over its cross-section and without non-homogeneities.
2. A method according to claim 1, wherein, for calendering, the fibrous web is guided, preheated, between heated calender rolls.
3. A method according to claim 1, wherein, for calendering, the fibrous web is guided, preheated, between cooled calender rolls.
4. A method according to claim 1, wherein, for calendering, the fibrous web is guided, unheated, between heated calender rolls.
5. A filter material, produced according to any of claims 1 to 4, wherein the spacers are formed by raised portions, the height of which corresponds to at least one quarter of the thickness of the filter material.
6. Apparatus for carrying out the method according to any of claims 1 to 4 and for producing a filter material according to claim 5, comprising calender rolls having a surface profiling which, viewed in cross-section, extends essentially sinusoidally in the axial direction.
7. Apparatus according to claim 6, wherein the ratio of the height of the surface profiling in the radial direction and the axial width between mutually adjacent vertices is 0.1 to 0.2, and the surface profiling is

continuous in the circumferential direction.

8. Apparatus for producing a pleatable filter material, substantially as described herein with reference to the accompanying drawing.





Application No: GB 9715598.0  
Claims searched: 1-8

Examiner: J P Leighton  
Date of search: 14 October 1997

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): B1D(DBEB, DBHA, DBHX, DDQA); B5A(AA1, AT19PA, AT19PC, AT19PD); B5B(BCG, BCM, BCN, BCP, BEB, BEC); D1R(RFL, RGL)

Int CI (Ed.6): B01D(39/14, 39/16); B29C(43/24); B29D(7/00, 7/01)

Other: Online:WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage		Relevant to claims
A	GB1417696A	Lantor Ltd.	6 at least
X	GB1372350A	Inst. Problem Materialovedenia see Fig.8	
A	GB1312560A	Monsanto Co.	6 at least
X	GB0725973A	Buss A G see Fig.1	
X	WO91/05483A1	United Biscuits (UK) Ltd. see Fig.2	

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined  
with one or more other documents of same category.  
& Member of the same patent family

A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before  
the filing date of this invention.  
E Patent document published on or after, but with priority date earlier  
than, the filing date of this application.

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